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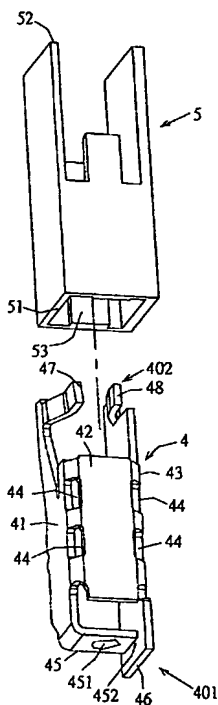
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[Continued on next page]

(54) Title: CONDUCTIVE TERMINAL AND THE ELECTRICAL CONNECTOR USING THE CONDUCTIVE TERMINAL



(57) Abstract: A conductive terminal and the electrical connector using the conductive terminal, the conductive terminal is received in a terminal channel defined in an insulative housing of the electrical connector which can transmit signal between an electronic component and a circuit board. The conductive terminal has a first wall, a second wall connecting with the first wall in a certain angle and a third wall connecting with the second wall in a certain angle and opposite to the first wall. The conductive terminal forms a mounting portion connecting with the solder ball. The mounting portion comprises a horizontal portion extending and bending from end of the first wall toward the third wall, and a vertical portion of the third wall and corresponding to the horizontal portion in a certain angle. The horizontal portion and the vertical portion adhere to the solder ball in two different directions so as to steadily locate the solder ball.

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1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31 32 33 34 35 36 37 38 39 40 41 42 43 44 45 46 47 48 49 50 51 52 53 54 55 56 57 58 59 60 61 62 63 64 65 66 67 68 69 70 71 72 73 74 75 76 77 78 79 80 81 82 83 84 85 86 87 88 89 90 91 92 93 94 95 96 97 98 99 100 101 102 103 104 105 106 107 108 109 110 111 112 113 114 115 116 117 118 119 120 121 122 123 124 125 126 127 128 129 130 131 132 133 134 135 136 137 138 139 140 141 142 143 144 145 146 147 148 149 150 151 152 153 154 155 156 157 158 159 160 161 162 163 164 165 166 167 168 169 170 171 172 173 174 175 176 177 178 179 180 181 182 183 184 185 186 187 188 189 190 191 192 193 194 195 196 197 198 199 200 201 202 203 204 205 206 207 208 209 210 211 212 213 214 215 216 217 218 219 220 221 222 223 224 225 226 227 228 229 230 231 232 233 234 235 236 237 238 239 240 241 242 243 244 245 246 247 248 249 250 251 252 253 254 255 256 257 258 259 260 261 262 263 264 265 266 267 268 269 270 271 272 273 274 275 276 277 278 279 280 281 282 283 284 285 286 287 288 289 290 291 292 293 294 295 296 297 298 299 300 301 302 303 304 305 306 307 308 309 310 311 312 313 314 315 316 317 318 319 320 321 322 323 324 325 326 327 328 329 330 331 332 333 334 335 336 337 338 339 340 341 342 343 344 345 346 347 348 349 350 351 352 353 354 355 356 357 358 359 360 361 362 363 364 365 366 367 368 369 370 371 372 373 374 375 376 377 378 379 380 381 382 383 384 385 386 387 388 389 390 391 392 393 394 395 396 397 398 399 400 401 402 403 404 405 406 407 408 409 410 411 412 413 414 415 416 417 418 419 420 421 422 423 424 425 426 427 428 429 430 431 432 433 434 435 436 437 438 439 440 441 442 443 444 445 446 447 448 449 450 451 452 453 454 455 456 457 458 459 460 461 462 463 464 465 466 467 468 469 470 471 472 473 474 475 476 477 478 479 480 481 482 483 484 485 486 487 488 489 490 491 492 493 494 495 496 497 498 499 500 501 502 503 504 505 506 507 508 509 510 511 512 513 514 515 516 517 518 519 520 521 522 523 524 525 526 527 528 529 530 531 532 533 534 535 536 537 538 539 540 541 542 543 544 545 546 547 548 549 550 551 552 553 554 555 556 557 558 559 560 561 562 563 564 565 566 567 568 569 570 571 572 573 574 575 576 577 578 579 580 581 582 583 584 585 586 587 588 589 590 591 592 593 594 595 596 597 598 599 600 601 602 603 604 605 606 607 608 609 610 611 612 613 614 615 616 617 618 619 620 621 622 623 624 625 626 627 628 629 630 631 632 633 634 635 636 637 638 639 640 641 642 643 644 645 646 647 648 649 650 651 652 653 654 655 656 657 658 659 660 661 662 663 664 665 666 667 668 669 670 671 672 673 674 675 676 677 678 679 680 681 682 683 684 685 686 687 688 689 690 691 692 693 694 695 696 697 698 699 700 701 702 703 704 705 706 707 708 709 710 711 712 713 714 715 716 717 718 719 720 721 722 723 724 725 726 727 728 729 730 731 732 733 734 735 736 737 738 739 740 741 742 743 744 745 746 747 748 749 750 751 752 753 754 755 756 757 758 759 760 761 762 763 764 765 766 767 768 769 770 771 772 773 774 775 776 777 778 779 780 781 782 783 784 785 786 787 788 789 790 791 792 793 794 795 796 797 798 799 800 801 802 803 804 805 806 807 808 809 810 811 812 813 814 815 816 817 818 819 820 821 822 823 824 825 826 827 828 829 830 831 832 833 834 835 836 837 838 839 840 841 842 843 844 845 846 847 848 849 850 851 852 853 854 855 856 857 858 859 860 861 862 863 864 865 866 867 868 869 870 871 872 873 874 875 876 877 878 879 880 881 882 883 884 885 886 887 888 889 890 891 892 893 894 895 896 897 898 899 900 901 902 903 904 905 906 907 908 909 910 911 912 913 914 915 916 917 918 919 920 921 922 923 924 925 926 927 928 929 930 931 932 933 934 935 936 937 938 939 940 941 942 943 944 945 946 947 948 949 950 951 952 953 954 955 956 957 958 959 960 961 962 963 964 965 966 967 968 969 970 971 972 973 974 975 976 977 978 979 980 981 982 983 984 985 986 987 988 989 990 991 992 993 994 995 996 997 998 999 1000 1001 1002 1003 1004 1005 1006 1007 1008 1009 1010 1011 1012 1013 1014 1015 1016 1017 1018 1019 1020 1021 1022 1023 1024 1025 1026 1027 1028 1029 1030 1031 1032 1033 1034 1035 1036 1037 1038 1039 1040 1

— before the expiration of the time limit for amending the claims and to be republished in the event of receipt of amendments

*For two-letter codes and other abbreviations, refer to the "Guidance Notes on Codes and Abbreviations" appearing at the beginning of each regular issue of the PCT Gazette.*

— *with international search report*

**CONDUCTIVE TERMINAL AND THE ELECTRICAL  
CONNECTOR USING THE CONDUCTIVE TERMINAL**

**Field of the Invention:**

The present invention generally relates to a conductive terminal and, more particularly, to a conductive terminal used in an electrical connector which can transmit signals between an electronic component and a circuit board via a solder ball connected with the circuit board.

**Background of the Invention:**

Referring to FIG. 1 to 3, as disclosed in T.W. patent application No. 087216147, publication No. 392975, an electrical connector 1 is a zero insertion force ("ZIF") electrical connector for electrically interconnecting a central processing unit ("CPU") and a mainboard used in computer device. The electrical connector 1 comprises an insulative housing 10 and a plurality of conductive terminals 2. Each of the conductive terminals 2 electrically connects with the circuit board 30 through surface mounting technology ("SMT") by pre-setting a solder ball 23 onto an end thereof.

The insulative housing 10 of the electrical connector 1 has a mounting surface 12 on the bottom surface thereof which is positioned proximate to the circuit board 30 and a receiving surface 11 on the top surface thereof for supporting the electronic component. The insulative housing 10 also defines a plurality of through holes 13 extending between the mounting surface 12 and the receiving surface 11.

Each of the conductive terminals 2 respectively received in the corresponding through holes 13 forms a contact portion 20 extending toward the receiving surface 11 and an end portion 21 opposite extending to the mounting surface 12. The end portion 21 has a bottom surface 22 for soldering with the corresponding solder ball 23.

To improve the success rate of pre-setting the solder ball 23 onto the end portion 21 of the conductive terminals 2, the end portion 21 forms a disk-shape plane approximately 90 degrees bending to the contact portion 20 so that the end portion 21 and the mounting surface 12 of the insulative housing 10 are approximately located in the same plane. The plane disk-shape end portion 21 provides a larger area of pre-setting the solder ball 23 so as to steadily pre-set the solder ball 23. In addition, a plurality of protrusions 25 is integrity extending from

the side of the end portion 21 for preventing the solder ball 23 dropping from the bottom surface 22 of the end portion 21.

To applying the SMT of pre-setting the solder ball 23, one end of the conductive terminal 2 must have a structure of easily locating and connecting the solder ball 23. The above method is only one of the resolving schemes with which the end portion of the conductive terminal 2 has different structures to locate and connect the solder ball 23. The present invention provides an improved conductive terminal to locate and connect the solder ball 23.

#### 10 **Summary of the Invention:**

An object of the present invention is to provide a conductive terminal that easily locates a solder ball and an electrical connector using the conductive terminals.

Another object of the present invention is to provide a conductive terminal enhancing steadiness of soldering with a solder ball.

15 The conductive terminals of the present invention are received in a plurality of terminal channels of an insulative housing of the electrical connector which can transmit signal between an electronic component and a circuit board. The conductive terminal has a first wall, a second wall connecting with the first wall in a certain angle and a third wall connecting with the second wall in a certain angle and opposite to the first wall. The  
20 conductive terminal forms a contact portion electrically connecting with the electronic component and a mounting portion electrically connecting with the circuit board via the solder ball. The mounting portion comprises a horizontal portion extending and bending from one end of the first wall toward the third wall, and an vertical portion on the third wall and corresponding to the horizontal portion in a certain angle. The horizontal portion and the  
25 vertical portion adhere to the solder ball in two different directions so as to steadily locate the solder ball.

A gap is defined between the vertical portion and a side face of the horizontal portion near the vertical portion. When the solder ball melts, tin flows into the gap so as to enhance steadiness of soldering between the solder ball and the mounting portion.

30 Other objects, features and advantages of the invention will be apparent from the following detailed description taken in connection with the accompanying drawings.

**Brief Description of the Drawings:**

The features of this invention which are believed to be novel are set forth with particularity in the appended claims. The invention, together with its objects and the advantages thereof, may be best understood by reference to the following description taken in  
5 conjunction with the accompanying drawings, in which like reference numerals identify like elements in the figures and in which:

FIG. 1 is a partial sectional view illustrating a conventional electrical connector;

FIG. 2 is a side partial sectional view illustrating of FIG. 1;

FIG. 3 is a perspective view of a conductive terminal of the conventional electrical  
10 connector of FIG. 1;

FIG. 4 is a perspective view of a conductive terminal inserting into an insulative housing of the present invention from under the insulative housing;

FIG. 5 is a perspective-assembled view of FIG. 4 illustrating a solder ball located in a mounting portion of the conductive terminal of the present invention;

FIG. 6 is a perspective view of a conductive terminal inserting into an insulative housing of the present invention from the above of the insulative housing; and  
15

FIG. 7 is a side view of the solder ball melting and connecting with the conductive terminal of the present invention.

**Detailed Description of the Preferred Embodiments:**

While the invention may be susceptible to embodiment in different forms, there is shown in the drawings, and herein will be described in detail, a specific embodiment with the understanding that the present disclosure is to be considered an exemplification of the principles of the invention, and is not intended to limit the invention to that as illustrated and  
25 described herein.

Referring now to FIG. 4 and FIG. 5, a conductive terminal 4 of the present invention used in an electrical connector is similar with the prior art and connects between an electronic component (not shown) and a circuit board (not shown). The conductive terminal 4 pre-sets a solder ball 6 onto an end thereof.

The electrical connector comprises an insulative housing 5 and a plurality of  
30 conductive terminals 4.

The insulative housing 5 has a mounting surface 51 which is positioned proximate to the circuit board (such as motherboard of a computer) and a receiving surface 52 for supporting the electronic component (such as central processing unit, CPU). The insulative

housing 5 defines a plurality of terminal channels 53 extending through the mounting surface 51 and the receiving surface 52. To easily illuminate, it is drawn in the FIGS. that the insulative housing 5 has a single terminal channel 53.

Each conductive terminal 4 is respectively received in the corresponding terminal channels 53. The conductive terminal 4 has a first wall 41, a second wall 42 connecting with one side of the first wall 41 in an approximately 90 degrees angle and a third wall 43 connecting with the other side of the second wall 42 in an approximately 90 degrees angle and opposite to the first wall 41 in some distance. The connecting corner of the first wall 41 and the second wall 42 defines a plurality of hollows 44 so as to make the connecting corner of the first wall 41 and the second wall 42 have lower intensity and the first wall 41 easily bend along the hollows 44. Similarly, the connecting corner of the third wall 43 and the second wall 42 defines a plurality of hollows 44 so as to make the third wall 43 easily bend along the hollows 44 to the second wall 42. When the conductive terminal 4 is respectively received in the corresponding terminal channel 53, one end of the conductive terminal 4 adjacent to the mounting surface 51 forms a mounting portion 401 and the opposite end to the mounting portion 401 of the conductive terminal 4 adjacent to the receiving surface 52 forms a contact portion 402.

The mounting portion 401 comprises a horizontal portion 45 extending and bending in an approximately 90 degrees from one end of the first wall 41 adjacent to the mounting surface 51 toward the third wall 43, and an vertical portion 46 extending from the third wall 43 and corresponding to the horizontal portion 45 in an approximately 90 degrees angle. Referring to FIG. 5, the horizontal portion 45 and the mounting surface 51 of the insulative housing 5 are approximately in a same plane. And the vertical portion 46 is extending out of the mounting surface 51 and forms a L-shaped structure with the horizontal portion 45 to locate the solder ball 6.

The contact portion 402 comprises a first spring arm 47 formed on one side of the first wall 41 adjacent to the receiving surface 52 and a second spring arm 48 formed on one side of the second wall 42 adjacent to the receiving surface 52. A free end of the first spring arm 47 and a free end of the second spring arm 48 are adjacent to form a spring receiving structure to provide an insert arm of an electrical component (not shown) inserting. Because the contact portion 402 is not the point of novelty of the present invention and its principle of electrically connecting is similar with a corresponding structure of the conductive terminal of the ZIF electrical connector (not shown), here it is not illuminated in detail.

Referring to FIG. 4 to FIG. 6, in assembly, the conductive terminal 4 can insert the corresponding terminal channels 53 of the insulative housing 5 from the mounting surface 51 of the insulative housing 5 (referring to FIG. 4) and the conductive terminal 4 can also insert the corresponding terminal channels 53 of the insulative housing 5 from the receiving surface 52 of the insulative housing 5 (referring to FIG. 6). When the conductive terminal 4 can insert the corresponding terminal channels 53 of the insulative housing 5 from the mounting surface 51 of the insulative housing 5, the vertical portion 46 of the mounting portion 401 of the conductive terminal 4 can hold the inserting conductive terminal 4. Contrary, when the conductive terminal 4 can also insert the corresponding terminal channels 53 of the insulative housing 5 from the receiving surface 52 of the insulative housing 5, one end of the second wall 42 forms a handle 49 corresponding to the first spring arm 47 and the second spring arm 48 to hold the inserting conductive terminal 4.

Referring to FIG. 4 and FIG. 5, the mounting portion 401 of the conductive terminal 4 locates the solder ball 6 by its horizontal portion 45 and vertical portion 46. When the solder ball 6 contacts the surface of the horizontal portion 45, the vertical portion 46 prevents the solder ball 6 moving along the extending direction of the horizontal portion 45 because the vertical portion 46 is in an approximately 90 degrees and forms a L-shaped structure with the horizontal portion 45. Therefore, when the solder ball 6 is put into the L-shape space defined by the horizontal portion 45 and the vertical portion 46, the solder ball 6 respectively connects the horizontal portion 45 and the vertical portion 46, and locates by them in two different directions. So the solder ball 6 need not accurately align the surface of the horizontal portion 45 and easily to locate.

In addition, to improve veracity of the solder ball 6 aligning, the horizontal portion 45 defines a recess 451. When the solder ball 6 connects with the horizontal portion 45, the solder ball 6 is received in the recess 451 of the horizontal portion 45 and enhances steadiness of locating the solder ball 6.

Referring to FIG. 7, a gap 452 is defined between the vertical portion 46 and a side face of the horizontal portion 45 near the vertical portion 46. When the solder ball 6 melts, tin flows into the gap 452 so that the solder ball 6 not only can respectively solder with the surfaces of the horizontal portion 45 and the vertical portion 46 in two different directions but also some tin of the solder ball 6 fasten in the gap 452 by embedding so as to enhance steadiness of soldering between the solder ball 6 and the mounting portion 401 of the conductive terminal 4.

The conductive terminal 4 has the first wall 41, the second wall 42 and the third wall 43. The conductive terminal 4 enhances steadiness of locating the solder ball 6 by the L-shape space defined by the horizontal portion 45 extending from the first wall 41 and the vertical portion 46 extending from the third wall 43. The gap 452 is defined between the  
5 vertical portion 46 and a side face of the horizontal portion 45 near the vertical portion 46 to provide tin of the melting solder ball 6 flows therein and enhance steadiness of soldering with the solder ball 6.

Although the present invention has been illustrated and described with respect to exemplary embodiment thereof, it should be understood by those skilled in the art that the  
10 various changes, omissions and additions may be made therein and thereto without departing from the spirit and scope of the present invention as set forth in the appended claims.



**CLAIMS:**

What is claimed is:

1. A conductive terminal capable of being received in a terminal channel defined in an insulative housing and between an electronic component and a circuit board, having a contact portion electrically connecting with the electronic component and a mounting portion electrically connecting with the circuit board via a solder ball, comprising:
  - 5 a first wall, a second wall connecting with the first wall in a certain angle and a third wall connecting with the second wall in a certain angle and opposite to the first wall, and the mounting portion comprising a horizontal portion extending and bending from one end of the first wall toward the third wall, and an vertical portion on the third wall and corresponding to the horizontal portion in a certain angle, the horizontal portion and the vertical portion
  - 10 adhering to the solder ball in two different directions so as to steadily locate the solder ball.
2. The conductive terminal of claim 1 in which the horizontal portion defines a recess in the surface of connecting with the solder ball so as to receive the solder ball.
3. The conductive terminal of claim 1 in which a gap is defined between the vertical portion and a side face of the horizontal portion near the vertical portion and when the solder ball melts, tin flows into the gap.
4. The conductive terminal of claim 1 in which the contact portion comprises a first spring arm formed on one side of the first wall and a second spring arm formed on one side of the second wall corresponding to the first spring arm, and the first spring arm and the second spring arm form a spring receiving structure to connect with the electrical component.
5. The conductive terminal of claim 1 in which one end of the second wall forms a handle.
6. An electrical connector for connecting between an electronic component and a circuit board via a plurality of solder balls soldering onto the circuit board, comprising:
  - an insulative housing forming a mounting surface adjacent to the circuit board and a receiving surface for supporting the electronic component, the insulative housing defining a

5 plurality of terminal channels extending through the mounting surface and the receiving surface; and

10 a plurality of conductive terminals respectively received in the corresponding terminal channels, the conductive terminal having a first wall, a second wall connecting with the first wall and a third wall connecting with the second wall opposite to the first wall, a horizontal portion extending and bending from one end of the first wall adjacent to the mounting surface toward the third wall, and an vertical portion extending from the third wall and corresponding to the horizontal portion in a certain angle, the horizontal portion and the vertical portion forming a mounting portion to steadily locate the solder ball.

7. The electrical connector of claim 6 in which the horizontal portion of the conductive terminal defines a recess in the surface of connecting with the solder ball so as to receive the solder ball.

8. The electrical connector of claim 6 in which the horizontal portion and the mounting surface of the insulative housing are approximately in a same plane, and the vertical portion is extending out of the mounting surface.

9. The electrical connector of claim 6 in which a gap is defined between the vertical portion and a side face of the horizontal portion near the vertical portion, and tin of the melting solder ball flows into the gap.

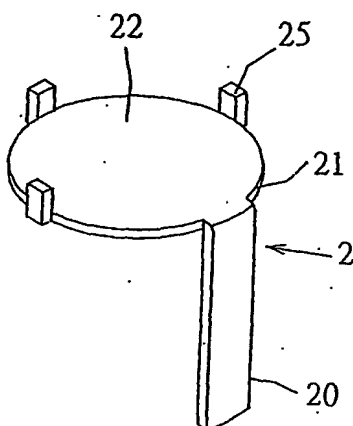
10. The electrical connector of claim 6 in which the conductive terminal comprises a first spring arm formed on one side of the first wall adjacent to the receiving surface and a second spring arm formed on one side of the second wall adjacent to the receiving surface, and the first spring arm and the second spring arm are adjacent to form a  
5 spring receiving structure.

11. The electrical connector of claim 6 in which one end of the second wall of the conductive terminal forms a handle adjacent to the receiving surface.



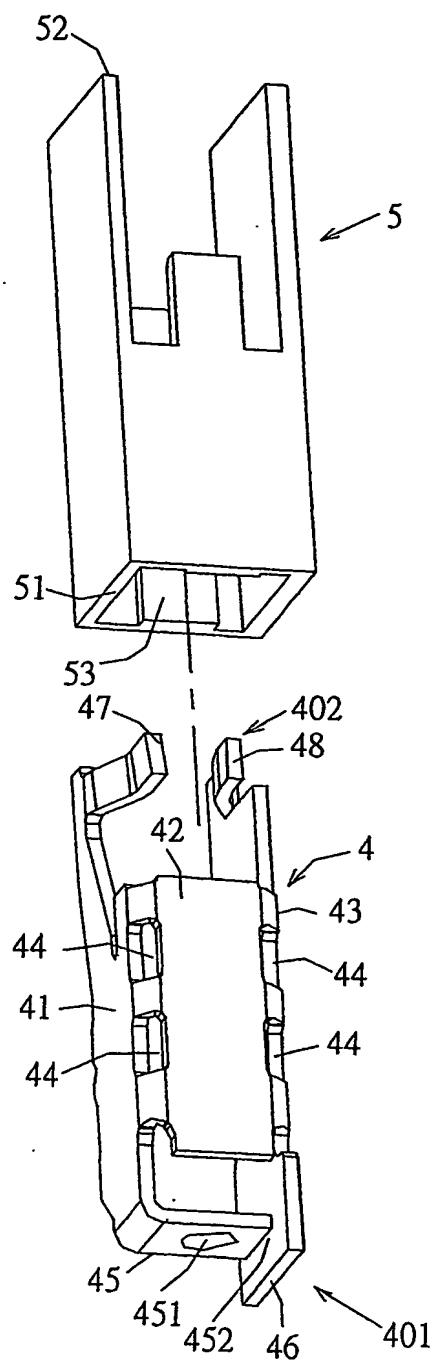
**FIG. 2**

## PRIOR ART



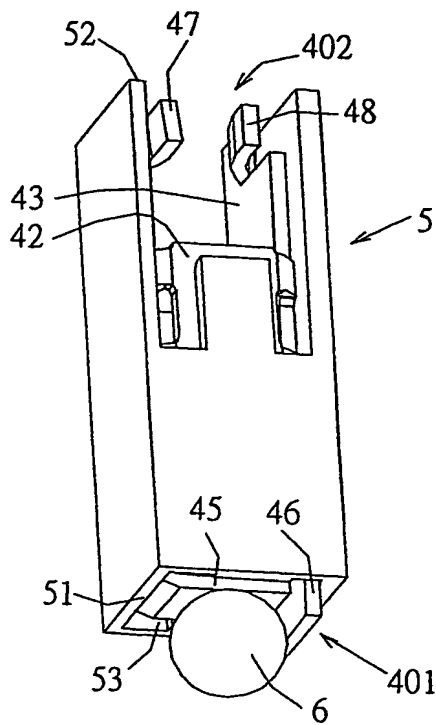
**FIG. 3**  
**PRIOR ART**

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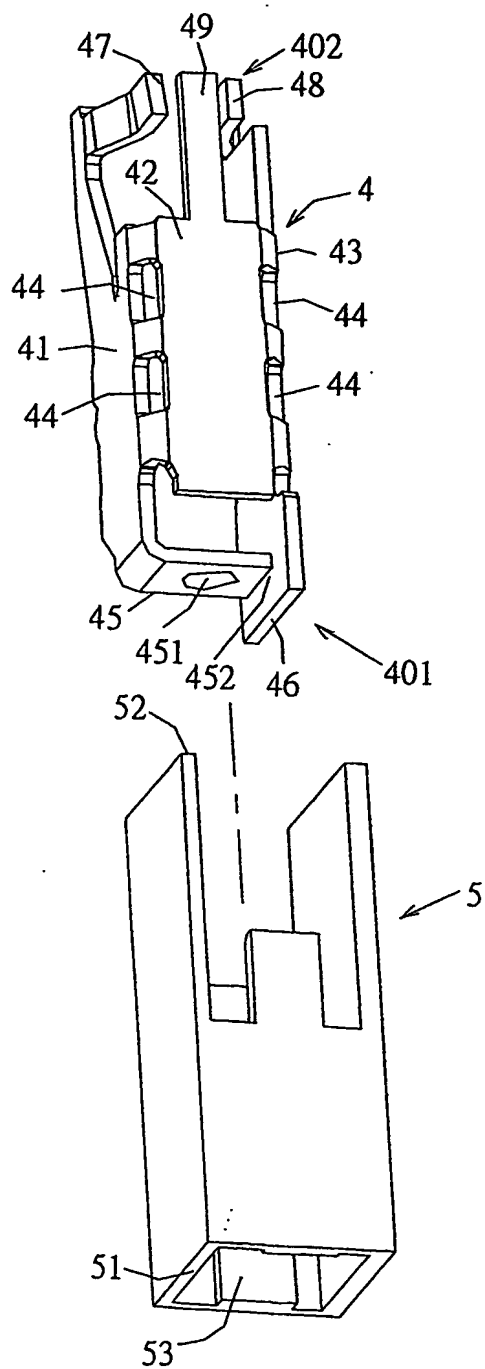
**FIG. 4**

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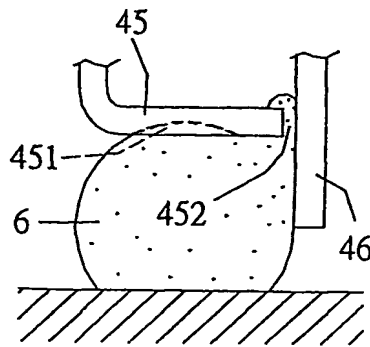
**FIG. 5**

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**FIG. 6**

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**FIG. 7**



# INTERNATIONAL SEARCH REPORT

Int'l Application No  
US2004/002819

A. CLASSIFICATION OF SUBJECT MATTER  
IPC 7 H01R4/02

According to International Patent Classification (IPC) or to both national classification and IPC

## B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

IPC 7 H01R H05K

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the International search (name of data base and, where practical, search terms used)

EPO-Internal

## C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	US 5 997 317 A (PEI WEN-CHUN ET AL) 7 December 1999 (1999-12-07) the whole document	1,6
A	US 6 062 890 A (WANG YU-MIN ET AL) 16 May 2000 (2000-05-16) figure 8	1

☐ Further documents are listed in the continuation of box C.

☒ Patent family members are listed in annex.

### \* Special categories of cited documents :

- \*A\* document defining the general state of the art which is not considered to be of particular relevance
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- \*P\* document published prior to the international filing date but later than the priority date claimed

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- \*Y\* document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art.
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Date of the actual completion of the international search

29 June 2004

Date of mailing of the International search report

08/07/2004

Name and mailing address of the ISA

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Corrales, D

# INTERNATIONAL SEARCH REPORT

Information on patent family members

International Application No  
US2004/002819

Patent document cited in search report		Publication date		Patent family member(s)	Publication date
US 5997317	A	07-12-1999	TW	392975 Y	01-06-2000
US 6062890	A	16-05-2000	TW	422458 Y	11-02-2001